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Research Document 2001/036

Document de recherche 2001/036

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The stock status of Atlantic salmon (*Salmo salar* L.) in English River, Labrador, 2000

État du stock de saumon de l'Atlantique (*Salmo salar* L.) de la rivière English, au Labrador, pour l'année 2000

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Ce document est disponible sur l'Internet à:

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ISSN 1480-4883
Ottawa, 2001

Canada

103-01270/

Abstract

The status of the Atlantic salmon (*Salmo salar* L.) stock in English River, Labrador in 2000 was determined using counting fence data, samples collected in the angling fishery, and records of angling mortalities. The stock assessment was conducted in relation to a commercial salmon fishery buyout in Labrador in 1998 and restrictions to the angling fishery. This is the second assessment for English River, Labrador. In 2000, total returns to the English River counting fence were 367 small and 15 large salmon. The number of spawners adjusted for angling mortalities were 359 small and 15 large salmon. Also, 1,005 small and 449 large Arctic charr and 613 brook trout were counted at the fence. Since this is the beginning of this project, there is a lack of information with which to derive conservation requirements. Counts of all fish species in 2000 increased over counts in 1999.

Résumé

L'état du stock du saumon de l'Atlantique (*Salmo salar* L.) dans la rivière English, au Labrador, a été déterminé en 2000 à partir du nombre de saumons dénombrés à une barrière de comptage, d'échantillons capturés par des pêcheurs à la ligne et de données sur les mortalités dues à la pêche à la ligne. L'évaluation du stock a été réalisée dans le contexte du rachat d'un permis de pêche commerciale du saumon au Labrador en 1998 et de restrictions à la pêche à la ligne. Il s'agit de la deuxième évaluation du stock de saumon de la rivière English. En 2000, 367 petits et 15 grands saumons sont remontés jusqu'à la barrière de comptage. Le nombre de géniteurs corrigés pour les mortalités dues à la pêche à la ligne était de 359 petits et 15 grands saumons. De plus, 1005 petits et 449 grands ombles chevaliers ainsi que 613 ombles de fontaine ont été dénombrés à la barrière de comptage. Comme le projet n'en est qu'à ses débuts, il n'existe pas assez d'information pour établir les besoins de conservation. Pour toutes les espèces, le nombre de poissons dénombrés a augmenté en 2000 par rapport à 1999.

INTRODUCTION

English River is located in northern Labrador in Salmon Fishing Area 1 (SFA 1) and flows into Kaipokok Bay about 8 km to the northeast of the town of Postville at 54^0 58' N 59^0 45' W (Anderson 1985) (Fig. 1). Near the mouth, the river is broken up into several islands and contains areas of gravel suitable for spawning and rearing (Murphy 1973). At 1 km above the river mouth, the river flows through a section of rapids with a small falls just below a large lake. Upstream from this lake, the river consists of a network of small ponds connected by stretches of river with boulder and rubble substrate. Four obstructions are found on English River of which only one is considered to be a full barrier to salmonid migration. There is a small angling fishery on English River conducted by residents of Postville and occasionally by non-local anglers. Anadromous Atlantic salmon (*Salmo salar* L.), Arctic charr (*Salvelinus alpinus* L.), and both sea-run and resident brook trout (*Salmo fontinalis* L.) have been reported in the system (Anderson 1985).

In 1992, several major changes were introduced to the management of Atlantic salmon in Newfoundland and Labrador. A moratorium was placed on commercial salmon fishing in the island portion of the province, quotas for the Labrador commercial fishery, first introduced in 1990, were reduced and a voluntary retirement of commercial salmon licences was instituted for all of the province. In 1998, the commercial fishery in Labrador was closed and fishermen were offered a buyout which most accepted. In 1999 and 2000, a food fishery of 10 tonnes was available for members of the Labrador Inuit Association including catches in Lake Melville, which is also in SFA 1. The West Greenland commercial salmon fishery, which was closed for the 1993 and 1994 fishing seasons, was open again for the 1995-98 fishing seasons but with a food fishery only in 1999-2000. Some English River multi-sea winter salmon may be caught in the Greenland fishery similar to other Labrador stocks (Pratt et al. 1974).

In the angling fishery, in 1992 and 1993, a quota on the number of fish that could be retained was introduced in each SFA. The quota was assigned for an entire SFA and was not administered on an individual river basis. Only hook-and-release fishing was permitted after the quota was caught. In 1994, quotas for the angling fishery were eliminated. In place of quotas, for Labrador, the season bag limit for retained salmon was lowered from eight to six fish, only two of which could be large salmon. In 1995 and 1996, the season bag limit for the angling fishery remained at six fish but only one large salmon could be retained. In 1999 and 2000, the angling fishery was restricted to a seasonal limit of four salmon retained, one of which could be large, and a daily limit of four salmon hooked-and-released. In 1999, use of barbless hooks became mandatory.

The main focus of this project, conducted in collaboration with the Labrador Inuit Association, was to assess the population of salmon in a northern Labrador river within the background of closed commercial fisheries and the new food fishery. This is the second counting facility to be operated in a river in SFA 1, in recent years. Thus, English River is one of the few Atlantic salmon rivers in Labrador for which quantitative data are available. In this paper, the stock status of the English River salmon population in 2000 is examined.

METHODS

Angling fisheries data

Catch and effort data from the angling fishery in Labrador are collected by the Department of Fisheries and Oceans (DFO) enforcement staff in conjunction with angling reports submitted by commercial sports camp operators and processed by DFO Science Branch. Procedures for the collection and compilation of angling fishery data are described by Ash and O'Connell (1987). However, as English River is not a scheduled river and because it has no sports fishing camp, angling data are not collected. In 1999 and 2000, counting fence staff kept records when possible of the number of salmon caught by anglers on English River.

In 1994, a new system, viz. the License Stub Return System (LSRS) was initiated for collecting angling statistics in Newfoundland and Labrador. It is based on attaching to the provincial angling licence a detachable stub upon which the angler can record details of where fished, when, and the numbers of salmon caught and released (O'Connell et al. 1998). Because of concerns over a lack of comparability of DFO angling statistics and the LSRS data, DFO data will continue to be used for Labrador. Since there are no DFO angling catch and effort data available for English River, data from the LSRS will be used for comparison with data collected by counting fence staff.

Adult salmon counts

COUNTING TECHNIQUES

Between 4 July and 6 July 2000, a counting fence was constructed approximately 0.5 km upstream from the mouth of the river (Fig. 2). Upstream migrating adult salmon were enumerated from 7 July to 3 October. The counting fence consisted of 39 sections (each 3 m long) which were installed according to the description in Anderson and McDonald (1978). The fence spanned two branches of the river with two counting fences installed one on either side of an island in the middle of the river. The fence was constructed of conduit and channel iron, supported by steel posts and 5 cm x 15 cm wooden supports similar to other portable counting fences used in Newfoundland and Labrador. The fence was operated with every conduit in place so that complete counts of salmon, trout and charr could be obtained. Operating dates of counting fences on English River:

1999: 1 July to 23 September
2000: 7 July to 3 October

Once the counting fence was completely installed, enumeration was done by manually releasing and counting salmon through a wooden fish trap using a dip net. Distinction between large and small salmon and charr was made by comparison to a known measure placed in the bottom of the fish trap. Large salmon were defined as those salmon with a fork length equal to or greater than 63 cm and small salmon are those less than 63 cm. For

charr, large fish are greater than or equal to 40 cm and small charr are less than 40 cm. Trout were not sized but were separated into resident and sea run based on external characteristics.

The counting fence remained intact the entire period from 7 July to 3 October. Water levels dropped during the time that the counting fence was in operation and the placement of vexar screens were not necessary as had been the case in 1999. Thus, the counts are considered to be complete and accurate.

Unrecorded Mortalities

Complete understanding of all life history factors including sources and levels of mortality is an important part of any stock assessment (Ricker 1975). Mortalities due to fishing, but not recorded as part of the catch statistics, have been defined as non-catch fishing mortality by Anon. (MS 1980) and Ricker (1976). Non-catch fishing mortality includes fish killed due both to illegal and legal fishing activities. Legal fishing mortality for salmon in Labrador include catches in native food and angling fisheries.

Another potential source of non-catch fishing mortality is from hook and release angling. Booth et al. (1995) and Brobbel et al (1996) have studied the effects of hook & release angling on the delayed mortality of 'bright' or returning salmon. They have indicated that the length of time spent in fresh water and water temperature at time of exhaustive exercise such as angling, have an effect on mortality rates. Fish that have spent longer periods of time in freshwater appear to have a lower mortality rate than those that have recently entered freshwater. Also, higher water temperatures increased the mortality rate. They concluded that mortality due to catch & release in a controlled environment was about 12%, although the sample size was small (n=25). A value of 10% from the mid-point of an assumed range of 5% to 15% was used.

Exploitation rates

Exploitation rates for the angling fishery were determined as the number of salmon reported to have been retained by the angling fishery divided by the total number of salmon entering the river.

Biological characteristics

Biological characteristics of adult Atlantic salmon were obtained from angling catches and adult salmon in the trap on days when water temperatures were suitable. Information on fork length to the nearest cm, weight of angled fish to the nearest 0.1 kg, sex of angled fish, and scales from the standard location aged as recommended by Shearer (1992) were collected. Sea trout and Arctic charr were sampled in the trap for fork length to the nearest cm and scales of sea trout were removed for age analysis.

Total river returns and spawning escapement

TOTAL RIVER RETURNS

Total river returns (TRR) were calculated separately for small and large salmon as follows:

$$TRR = RC_b + C + HRM_b$$

where,

RC_b = angling catch below counting fence
C = count of fish at counting fence
HRM_b = 0.1 * No. of fish caught & released below counting fence.

SPAWNING ESCAPEMENT

Spawning escapement (SE) was calculated as the difference between the number of fish released from the counting fence (FR) and the angling catch retained above the fence (RC_a) minus 10% of catch and release fish above the counting fence (HRM_a).

$$SE = (FR - RC_a) - HRM_a$$

Species distribution survey

Standard fyke nets with a mesh size of 2.0 cm and collection bag of 0.5 cm were fished in English River Big Pond in order to determine species, relative abundance and distribution in English River. Locations, set, species and numbers caught were recorded.

Environmental data

During field operations, environmental data were collected at the fence site. Water temperatures were recorded by Hugrun thermograph set at 1 m from the surface at the fence site. Cloud cover, relative water levels, weather conditions and air temperatures were also recorded. Water chemistry was determined using a LaMotte Model AQ-2 kit. A YSI Corporation Model 30 meter was used to determine water temperatures in English River Pond at 1 m intervals to a depth of 14 m.

RESULTS

Angling and food fisheries data

In 2000, there were 8 small salmon retained above the counting fence. There are no records of hooked and released salmon. Records for the food fishery kept by fishers in logbooks and compiled by the Aboriginal Fishery Guardian in Postville indicate landings of 467 small salmon, 162 large salmon, 1,586 charr and 750 sea trout (pers. comm. M. Andersen, LIA, Goose Bay, Labrador). The reporting rate was very high at 92% of the 79 licences (six fishers who did not fish also did not report).

Adult counts

In 2000, a total of 367 small salmon and 15 large salmon was counted upstream through the adult fence between 7 July and 3 October (Table 1a, Fig. 3a). During the same period, 1,005 small and 449 large charr were counted along with 264 resident brook trout and 300 sea trout (Table 1b & c). These counts are accurate and since there was no angling below the counting fence the counts are also the total returns to the river.

Daily counts of salmon, charr and sea trout indicate that in 2000, salmon entered the river earliest followed by large charr, small charr and trout (Fig. 3a). Runs continued into late September and early October; although the majority of fish entered during the last two weeks of July and 1st two weeks of August. Comparison of cumulative counts expressed as a percent of the total between 1999 and 2000, indicated that salmon were on average about two weeks early in 2000 than in 1999 (Fig. 3b). However, 1999 sea run trout and small charr were both earlier in 1999 than 2000; while large charr were similar both years.

Exploitation rates

The angling statistics collected by the counting fence staff show 8 small salmon and 0 large salmon were retained in 2000 (Table 2). All angling activity took place above the counting fence. In 2000, exploitation rates in the angling fishery were 2.2% for small retained salmon and 0% for large retained salmon as follows:

Year	Small Retained	Small Released	Large retained	Large released
2000	2.2	0	0	0
1999	8.5	0	4.2	0

Indications are that the angling fishery on English River declined in 2000 compared to 1999.

Total river returns and spawning escapement

In 2000, the total river returns to English River were 367 small and 15 large salmon (Table 2). All counts are considered complete since the first fish caught in the food fishery was on 3 July and there were no fish sited in the river during counting fence installation. There were no angled salmon retained below the counting fence and 8 small and 0 large salmon above. The spawning escapement was 359 small and 15 large salmon corrected for angling catches.

Biological Sampling

In 2000, seven adult salmon were sampled from the angling fishery and 70 at the counting fence traps (Table 3). The number of samples are too few to adequately define sex ratios and weights for English River salmon; however, data on length and age information is adequate. Mean fork length (FL) of the salmon was 54.0 cm and mean whole weight (WW) was 1.6 kg (Table 3). The large salmon sampled were all 2SW salmon with a mean fork length of 73.3 cm while small salmon were grilse and had a mean fork length of 53.2 cm. Small salmon sampled were 17% female (N=6) and no large salmon were available for sex determination. Freshwater (river) age for all salmon was 4(6%) – 3 year old, 50(70%) – 4 year olds, and 17(24%) – 5 year olds. Sea ages of the samples were 74 grilse and 3 2SW. The fork length distributions of sea trout and charr indicate a wide range of sizes were entering English River (Fig. 4).

Species distribution survey

In total, there were 33 sets made in English River Big (L1 on fig. 2) and Deer ponds in 2000. In total, there were 155 brook trout, one lake trout, one Arctic charr, eight salmon parr, nine salmon smolts, two sea run salmon, 316 sticklebacks caught (Table 4).

Environmental data

Figure 5 shows the daily minimum and maximum water temperatures and levels at the fence on English River in 2000. Water temperatures relative to more southerly rivers were cool in 2000; however maximum temperatures of 22 °C were still achieved. Water levels which were high when the fence was installed dropped continually over the summer and had only increased slightly from minimum values when the fence was removed in early October. Water levels in 1999 compared to 2000 indicated very different patterns between these two years (Fig. 6). The patterns of daily water temperatures are also different between 1999 and 2000 with 2000 water temperatures being generally slightly warmer than in 1999 (Fig. 7). Water chemistry in samples collected at trap 1 on four days indicate satisfactory water conditions for fish life (Table 5). Water temperature profiles were also collected at four stations in English River Pond on 19 August, 2000 (Fig. 8). The profiles indicate that conditions are different throughout the pond. Water temperatures were stable over the four sites down to 5 m depth with a thermocline extending from 5 m to about 8 to 11 m depending on the site.

DISCUSSION

In 2000, a total of 382 salmon, 1,454 charr and 613 brook trout were counted at the counting fence on English River. Since there were no removals in the river below the counting fence, these counts are the total returns to the river and are considered to be complete. Comparable count information is available for 1999 when a total of 107 salmon, 296 charr and 82 brook trout were counted (Reddin et al. 2000). Counts have increased substantially in 2000 over those of 1999. Reddin et al. (2000) noted the low numbers of all species of fish in 1999 at English River and increases in numbers should augment spawners and returns in future years as well as substantially improving status of fish stocks on English River.

Because this is only the second year of the English River project, it is difficult to put these counts into a conservation perspective similar to what is done for other rivers in Newfoundland and Labrador (CSAS 2000). For English River, conservation requirements in terms of habitat area are not yet available but are being developed as the project progresses. In northern Labrador, only one other river has total return and conservation requirement information, viz. Big Brook, which is to the south of English River (Reddin & Short 2000). It is recommended that the assessment be repeated in 2001 along with research directed at measuring the available habitat and furthering collection of information on species distribution. Also, assessments should be conducted on other northern Labrador rivers. Some consideration should be given to verifying and if necessary refining for Labrador rivers, the applicability of the standard conservation requirement for Eastern Canada of 240 eggs per 100 m^2 of parr-rearing habitat. This standard conservation requirement was derived from salmon rivers in the southern range of their distribution (Chaput MS 1997) and there is concern for its relevance for rivers in Labrador. Possibly lower conservation requirements for Labrador rivers compared to the rivers from which the standard conservation requirements were developed could arise from the underlying geology, climate and the presence of other salmonids, i.e. sea trout and charr that are absent to the south. On the other hand, Labrador rivers due to their isolation remain relatively pristine and unpolluted compared to some more southerly rivers. Fish stocks and in particular salmonids, which require clean and relatively cool water, should benefit from this isolation.

Murphy (1973) considers that English River is capable of producing circa. 3,000 salmon annually. If 3,000 salmon is an appropriate value for its production capabilities, then current levels are far below it. However, it should be kept in mind that total returns of salmon to English River are not equivalent to total production, as some salmon produced at English River would have been taken in the food fishery in 1999-2000 in Kaipokok Bay. Although in recent years, as a result of the closure of the commercial fishing effort, a higher proportion of the total population would be found in freshwater.

In the absence of suitable conservation requirements, an alternate means by which comparisons of salmon abundance can be made is to scale numbers of salmon and other salmonids returning to the river relative to the watershed drainage area. Thus, for English River comparisons of the numbers of returning salmon versus those of other rivers in Labrador where total returns are also known are relevant. In doing this for 2000 values, Big Brook has

a value of 1.43 salmon per km ^{2}, compared to 1.17 for English River. Sand Hill River, in southern Labrador, was assessed from 1994 to 1996 during the commercial fishery and had a value of 2.6 salmon per km^2. Paradise River in Sandwich Bay, Labrador had 0.98 salmon per km ^{2} in 1999. In contrast, two rivers on the northern peninsula of Newfoundland, viz. Torrent River and Western Arm Brook have corresponding conservation requirements in the range of 1.1 to 2.0 salmon per km^2 of drainage. Actual returns for these rivers are above conservation requirements, ranging from 8 to 10 salmon per km^2. These comparison suggest that returns of salmon to English River are low; however, it has increased considerably over the value of 0.33 per km ^{2} recorded in 1999.

English River is not unusual for a northern Labrador river in that it has substantial stocks of sea trout and Arctic charr as well as salmon. In terms of total salmonids, including sea trout and charr, the number of fish per unit drainage area for English River increases to 6.63 fish per km^2 while Sand Hill and Big Brook remain the same as they have only a few charr and trout. Southwest Brook on Paradise River has a value of 1.7 salmonids per km^2 on average, 1998-99. Fraser River measured in the 1970s had 2.3 while Ikarut River and Reid Brook had values of 5.9 and 5.1 per km^2, respectively (B. Dempson, pers. comm.). Comparison of these values to English River values in 2000 suggests that returns to English River were satisfactory in 2000; although low in 1999. There are a number of potential causes of low returns some of which are unique to Labrador rivers. One such possibility is predation by seals. Ranger seals (*Phoca vitulina*), grey seals (*Halichoerus grypus*) and harp seals (*Phoca groenlandica*) occur in Kaipokok Bay and in the estuary of English River. Seals were observed during travel by boat to English River in Kaipokok Bay feeding on fish populations.

Exploitation patterns of fish stocks are important information for stock assessments. Because of a lack of assessments on northern and southern Labrador rivers, this information is generally lacking. For English River, angling exploitation rates in 2000 on small retained salmon were 2% and 0% on large salmon. There were no records of any salmon being hooked-and-released. Exploitation rates are also available for Big Brook in 1997 and 1999-2000 of 9.7% on small retained salmon, 7.9% on small released salmon, 5.3% on large retained salmon and 2.5% on large released salmon. Exploitation rates are also available for Sand Hill River in southern Labrador (Reddin et al. 1995). In the early 1970s, average exploitation rates averaged 6% on small salmon and 2% on large salmon. In the 1990s, exploitation had increased to 11% on retained small salmon and 4% on retained large salmon. For released salmon, exploitation rates were 14% on small salmon and 4% on large salmon. Exploitation levels in the angling fishery on English River are low compared to other rivers in Labrador.

In conclusion, this paper summarizes the available information on the salmonid populations in English River, Labrador. This is the second assessment of the fish populations and in particular salmon in English River and the second river to be assessed in northern Labrador. Assessment of English River should be repeated to obtain assessment information for northern Labrador rivers in future years.

ACKNOWLEDGEMENTS

Employees of the Labrador Inuit Association (B. Jacques, J. Jacques, S. Jacques, M. Jacques and H. Jacques) diligently counted and measured fish at the English River counting fence and are gratefully acknowledged. Mr. R. Edmunds, M. Pilgrim, E. Andersen, and B. Andersen contributed to the planning and site selection for the English River project. The continued support of the executive of the Labrador Inuit Association and in particular Mr. M. Andersen is much appreciated.

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Fig. 1. Location map depicting Labrador, Salmon Fishing Areas (SFAs) and English River.

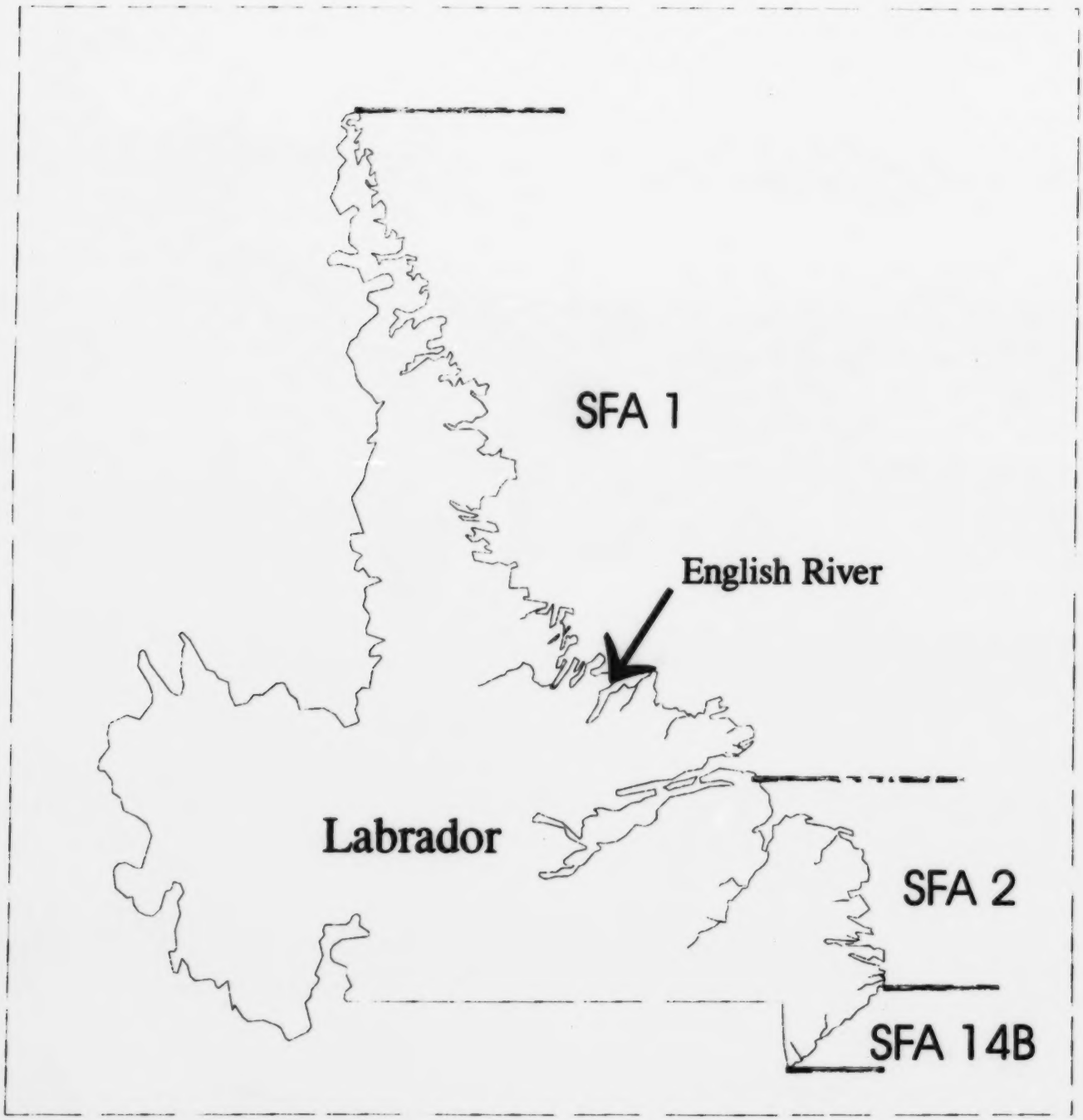

Fig. 2. Location map for English River, Labrador. L - are lakes, T - are tributaries, 1 - 4 are obstructions, and CF - is the counting fence.

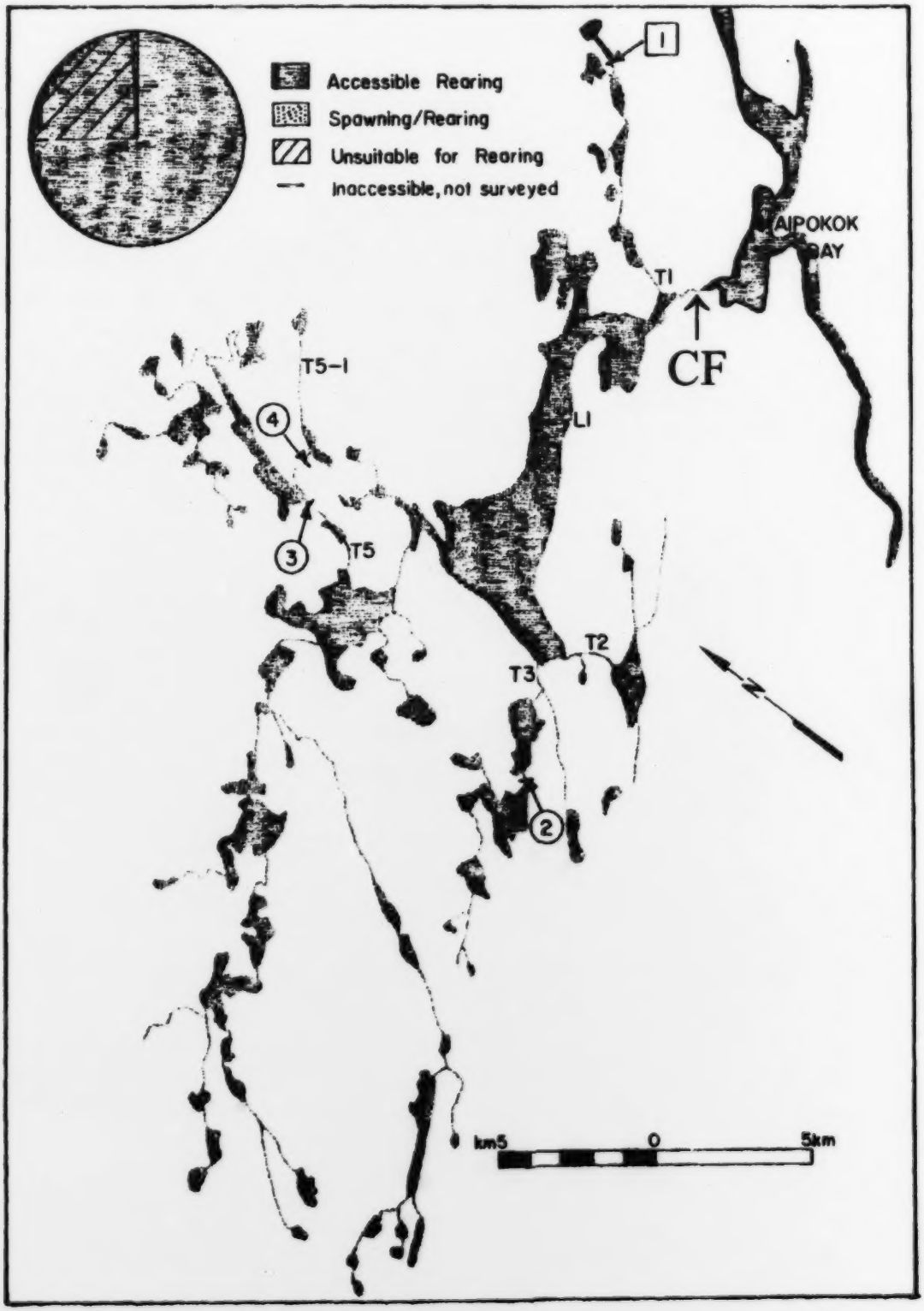

Fig. 3a. Daily counts of salmon, charr, and trout at English River, 2000.

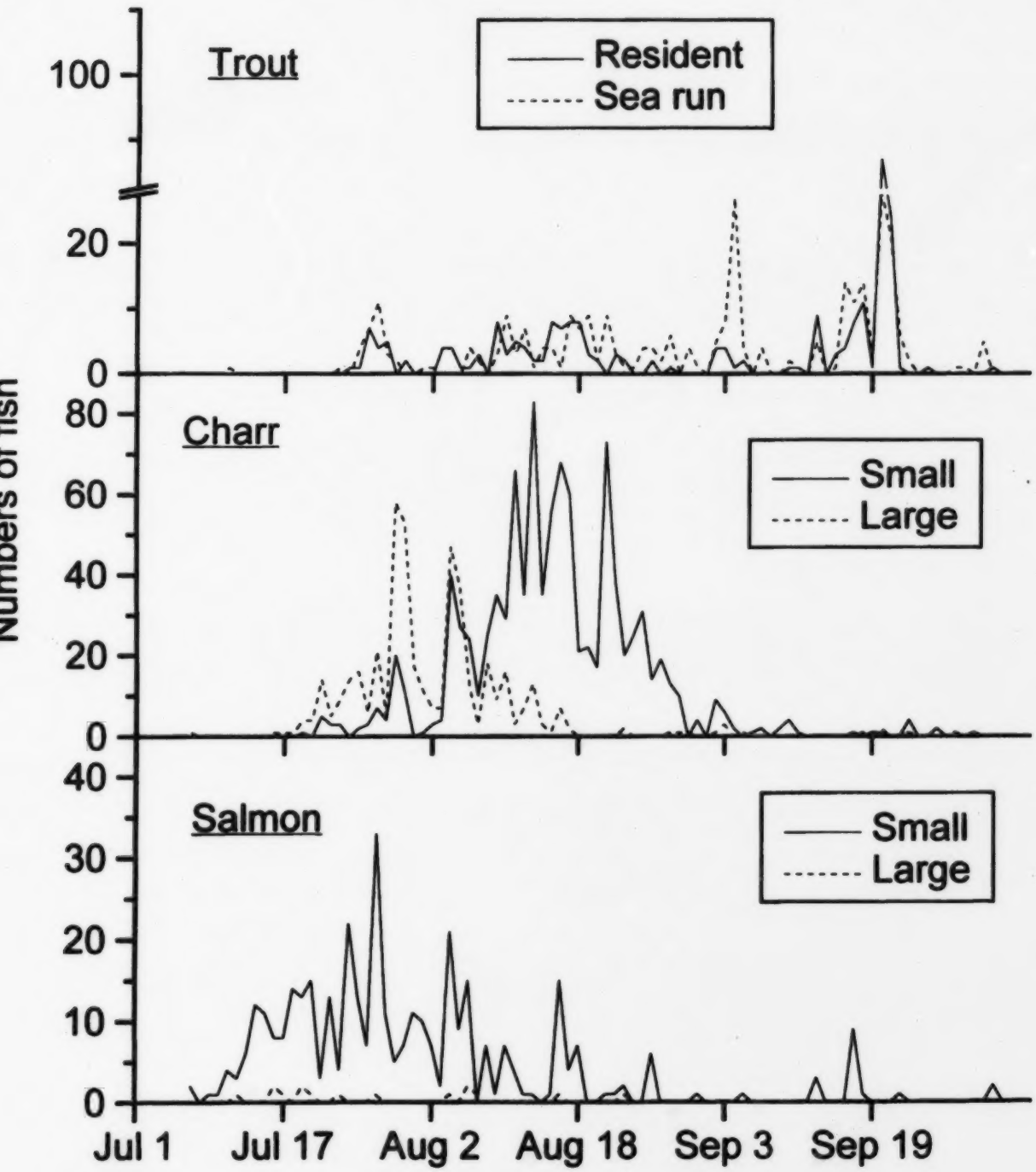

Fig. 3b. Comparison of counts at English River in 1999 and 2000.

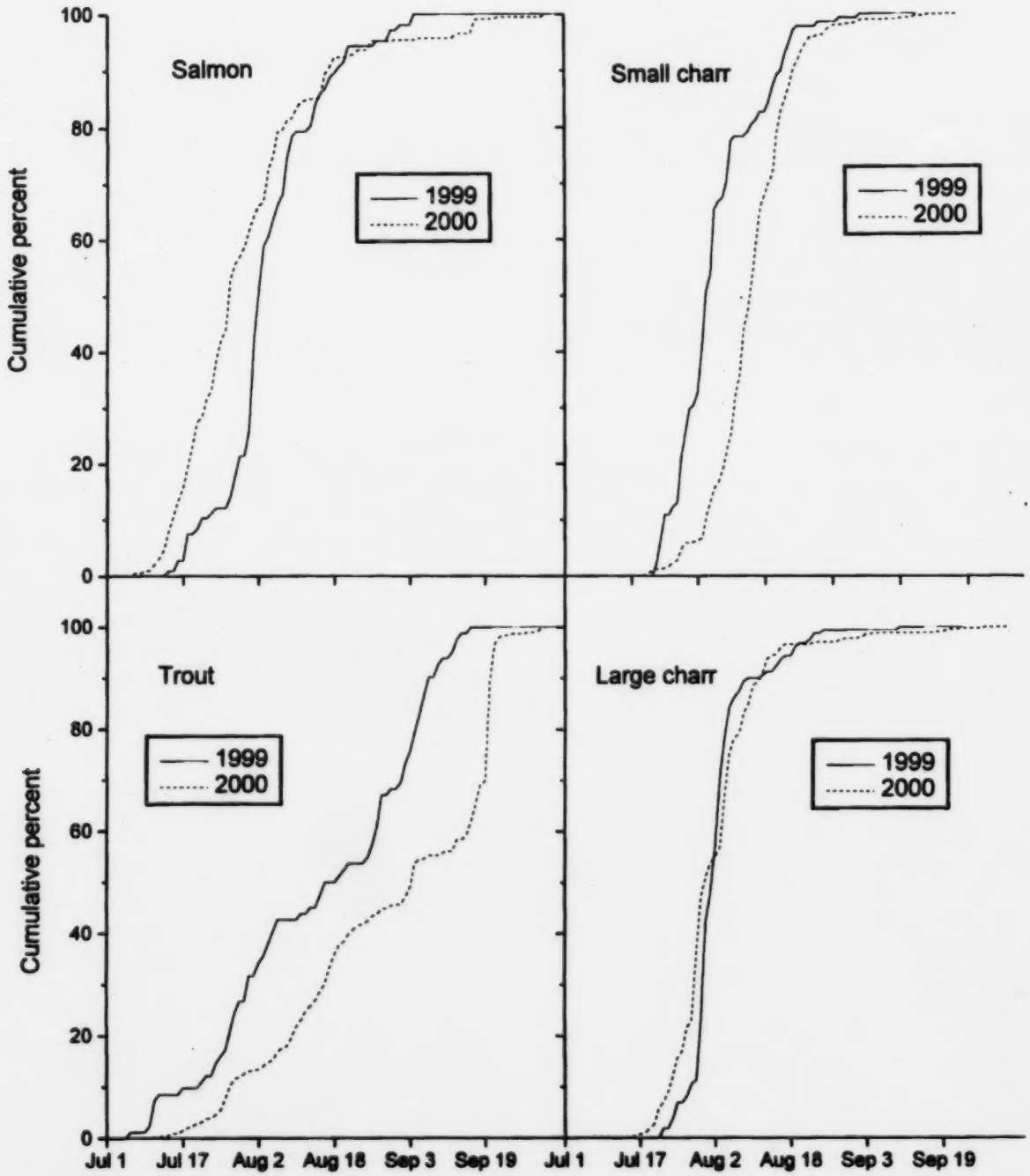

Fig. 4. Fork length distributions for sea trout and Arctic charr sampled at English River counting fence, 2000.

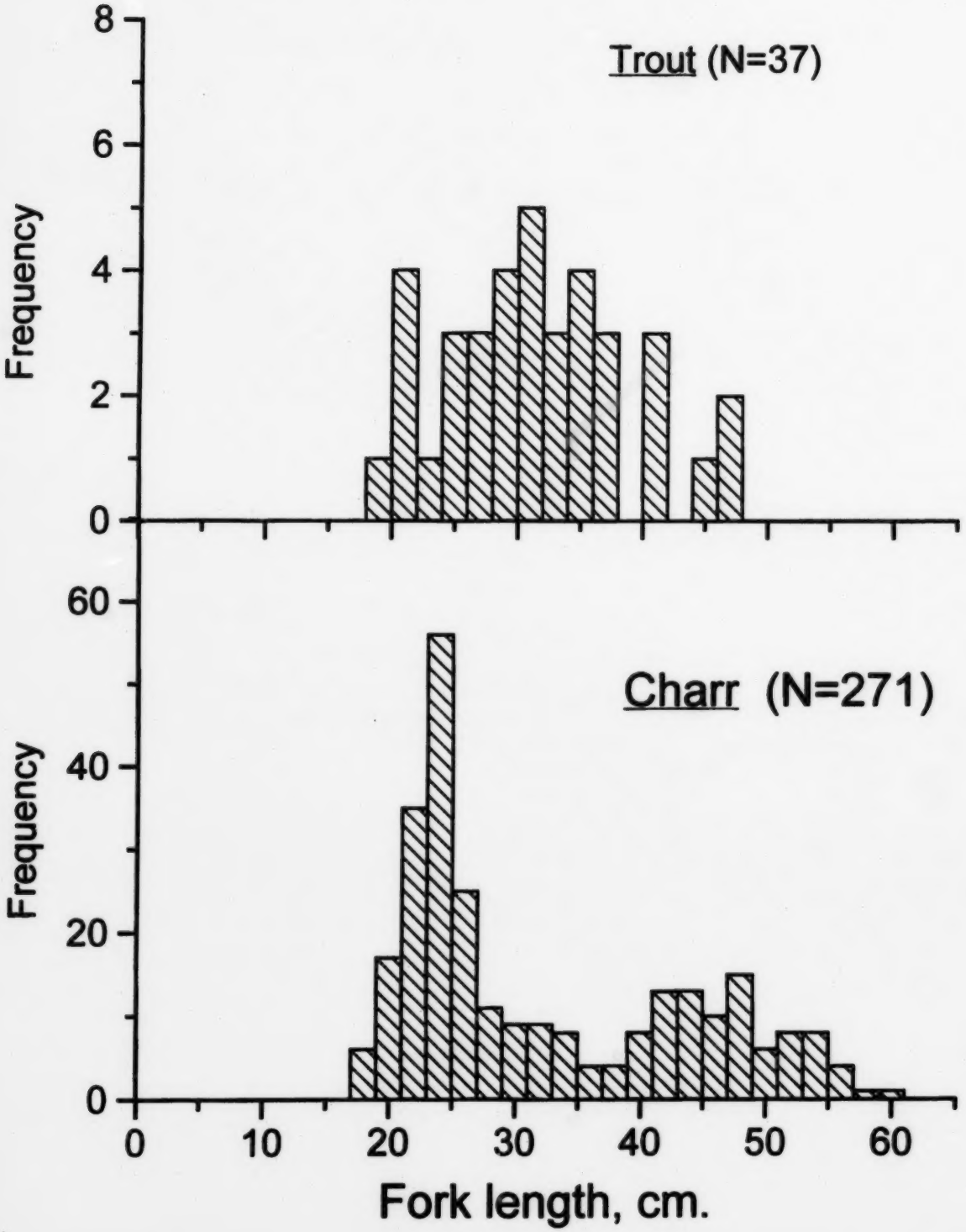

Fig. 5. Water temperatures and levels at English River, Labrador in 2000. Solid lines are minimum and maximum daily water temperatures and dashed line is water level.

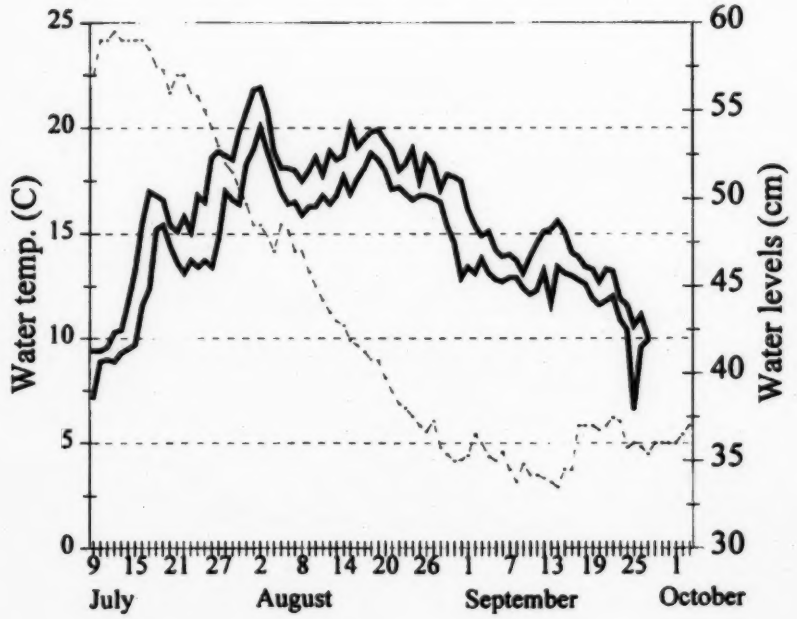

Fig. 6. Comparative water levels at English River, Labrador in 1999 and 2000.

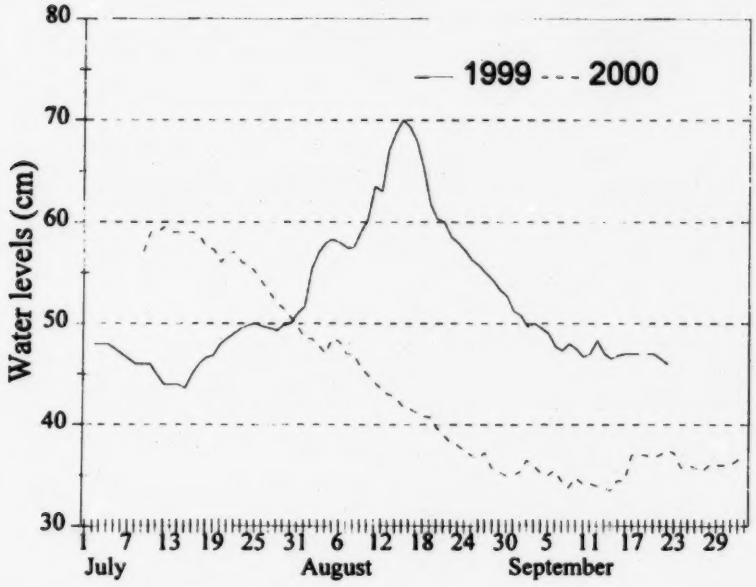

Fig. 7. Comparative water temperatures at English River, Labrador in 1999 and 2000.

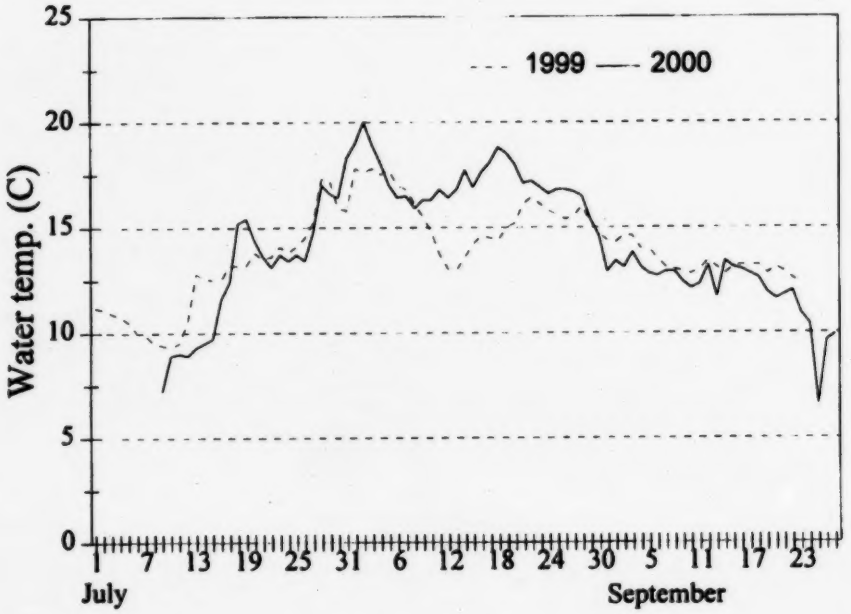

Fig. 8. Water temperatures at 4 stations on English River Pond on 19 August, 2000. Station 1 is at western and Station 4 at eastern end of pond.

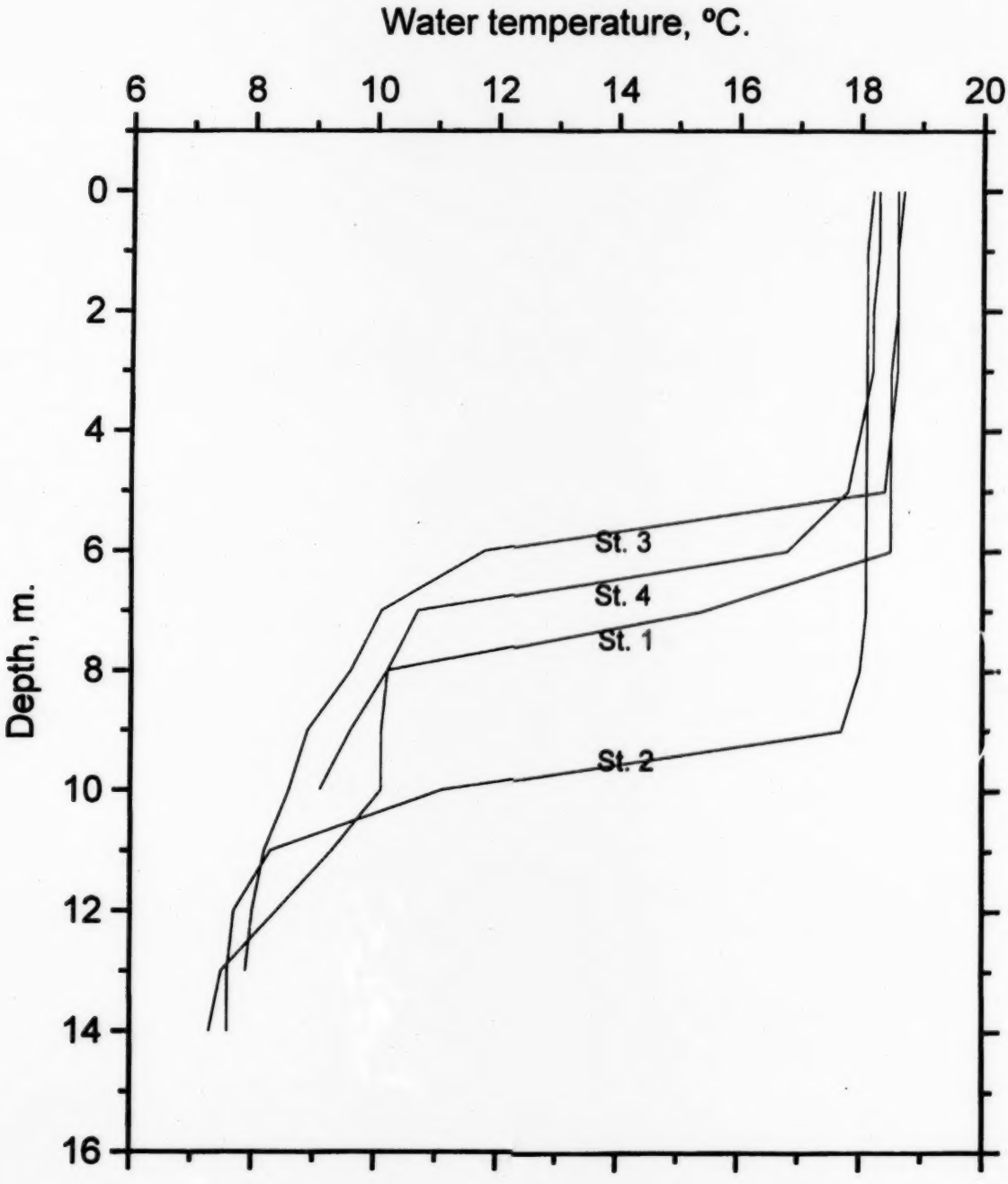

Table 1a. Daily counts of upstream migrating Atlantic salmon at English River, Labrador in 2000. Fence in operation from July 7 to October 3, 2000.

	Number of salmon			Cumulative numbers			Cumulative percentages			% large
DATE	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	salmon
7 July	2	0	2	2	0	2	0.5	0.0	0.5	0
8 July	0	0	0	2	0	2	0.5	0.0	0.5	
9 July	1	0	1	3	0	3	0.8	0.0	0.8	0
10 July	1	0	1	4	0	4	1.1	0.0	1.0	0
11 July	4	0	4	8	0	8	2.2	0.0	2.1	0
12 July	3	1	4	11	1	12	3.0	6.7	3.1	25
13 July	6	0	6	17	1	18	4.6	6.7	4.7	0
14 July	12	0	12	29	1	30	7.9	6.7	7.9	0
15 July	11	0	11	40	1	41	10.9	6.7	10.7	0
16 July	8	2	10	48	3	51	13.1	20.0	13.4	20
17 July	8	1	9	56	4	60	15.3	26.7	15.7	11
18 July	14	0	14	70	4	74	19.1	26.7	19.4	0
19 July	13	2	15	83	6	89	22.6	40.0	23.3	13
20 July	15	1	16	98	7	105	26.7	46.7	27.5	6
21 July	3	0	3	101	7	108	27.5	46.7	28.3	0
22 July	13	0	13	114	7	121	31.1	46.7	31.7	0
23 July	4	1	5	118	8	126	32.2	53.3	33.0	20
24 July	22	0	22	140	8	148	38.1	53.3	38.7	0
25 July	13	0	13	153	8	161	41.7	53.3	42.1	0
26 July	7	0	7	160	8	168	43.6	53.3	44.0	0
27 July	33	1	34	193	9	202	52.6	60.0	52.9	3
28 July	11	0	11	204	9	213	55.6	60.0	55.8	0
29 July	5	0	5	209	9	218	56.9	60.0	57.1	0
30 July	7	0	7	216	9	225	58.9	60.0	58.9	0
31 July	11	0	11	227	9	236	61.9	60.0	61.8	0
1 August	10	0	10	237	9	246	64.6	60.0	64.4	0
2 August	7	0	7	244	9	253	66.5	60.0	66.2	0
3 August	2	0	2	246	9	255	67.0	60.0	66.8	0
4 August	21	1	22	267	10	277	72.8	66.7	72.5	5
5 August	9	0	9	276	10	286	75.2	66.7	74.9	0
6 August	15	2	17	291	12	303	79.3	80.0	79.3	12
7 August	0	1	1	291	13	304	79.3	86.7	79.6	100
8 August	7	0	7	298	13	311	81.2	86.7	81.4	0
9 August	1	0	1	299	13	312	81.5	86.7	81.7	0
10 August	7	0	7	306	13	319	83.4	86.7	83.5	0
11 August	4	0	4	310	13	323	84.5	86.7	84.6	0
12 August	1	0	1	311	13	324	84.7	86.7	84.8	0
13 August	1	0	1	312	13	325	85.0	86.7	85.1	0
14 August	0	0	0	312	13	325	85.0	86.7	85.1	
15 August	1	0	1	313	13	326	85.3	86.7	85.3	0
16 August	15	1	16	328	14	342	89.4	93.3	89.5	6
17 August	4	0	4	332	14	346	90.5	93.3	90.6	0
18 August	7	0	7	339	14	353	92.4	93.3	92.4	0
19 August	0	0	0	339	14	353	92.4	93.3	92.4	
20 August	0	0	0	339	14	353	92.4	93.3	92.4	
21 August	1	0	1	340	14	354	92.6	93.3	92.7	0
22 August	1	0	1	341	14	355	92.9	93.3	92.9	0
23 August	2	1	3	343	15	358	93.5	100.0	93.7	33
24 August	0	0	0	343	15	358	93.5	100.0	93.7	
25 August	0	0	0	343	15	358	93.5	100.0	93.7	
26 August	6	0	6	349	15	364	95.1	100.0	95.3	0
27 August	0	0	0	349	15	364	95.1	100.0	95.3	
28 August	0	0	0	349	15	364	95.1	100.0	95.3	
29 August	0	0	0	349	15	364	95.1	100.0	95.3	
30 August	0	0	0	349	15	364	95.1	100.0	95.3	
31 August	1	0	1	350	15	365	95.4	100.0	95.5	0
1 Sept	0	0	0	350	15	365	95.4	100.0	95.5	
2 Sept	0	0	0	350	15	365	95.4	100.0	95.5	
3 Sept	0	0	0	350	15	365	95.4	100.0	95.5	
4 Sept	0	0	0	350	15	365	95.4	100.0	95.5	
5 Sept	1	0	1	351	15	366	95.6	100.0	95.8	0
6 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
7 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
8 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
9 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
10 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
11 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
12 Sept	0	0	0	351	15	366	95.6	100.0	95.8	
13 Sept	3	0	3	354	15	369	96.5	100.0	96.6	0
14 Sept	0	0	0	354	15	369	96.5	100.0	96.6	
15 Sept	0	0	0	354	15	369	96.5	100.0	96.6	
16 Sept	0	0	0	354	15	369	96.5	100.0	96.6	
17 Sept	9	0	9	363	15	378	98.9	100.0	99.0	0
18 Sept	1	0	1	364	15	379	99.2	100.0	99.2	0
19 Sept	0	0	0	364	15	379	99.2	100.0	99.2	
20 Sept	0	0	0	364	15	379	99.2	100.0	99.2	
21 Sept	0	0	0	364	15	379	99.2	100.0	99.2	
22 Sept	1	0	1	365	15	380	99.5	100.0	99.5	0
23 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
24 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
25 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
26 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
27 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
28 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
29 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
30 Sept	0	0	0	365	15	380	99.5	100.0	99.5	
01 Oct	0	0	0	365	15	380	99.5	100.0	99.5	
02 Oct	2	0	2	367	15	382	100.0	100.0	100.0	0
03 Oct	0	0	0	367	15	382	100.0	100.0	100.0	
Total	367	15	382							

Table 1b. Daily counts of upstream migrating Arctic charr at English River, Labrador in 2000. Fence in operation from 7 July to 3 October, 2000.

	Number of charr		Cumulative numbers			Cumulative percentages			% large
DATE	SMALL	LARGE	SMALL	LARGE	TOTAL	SMALL	LARGE	TOTAL	charr
7 July	0	1	0	1	1	0.0	0.2	0.1	100
8 July	0	0	0	1	1	0.0	0.2	0.1	
9 July	0	0	0	1	1	0.0	0.2	0.1	
10 July	0	0	0	1	1	0.0	0.2	0.1	
11 July	0	0	0	1	1	0.0	0.2	0.1	
12 July	0	0	0	1	1	0.0	0.2	0.1	
13 July	0	0	0	1	1	0.0	0.2	0.1	
14 July	0	0	0	1	1	0.0	0.2	0.1	
15 July	0	0	0	1	1	0.0	0.2	0.1	
16 July	0	1	0	2	2	0.0	0.4	0.1	100
17 July	0	1	0	3	3	0.0	0.7	0.2	100
18 July	0	1	0	4	4	0.0	0.9	0.3	100
19 July	1	4	1	8	9	0.1	1.8	0.6	80
20 July	0	4	1	12	13	0.1	2.7	0.9	100
21 July	5	14	6	26	32	0.6	5.8	2.2	74
22 July	3	5	9	31	40	0.9	6.9	2.8	63
23 July	3	9	12	40	52	1.2	8.9	3.6	75
24 July	0	14	12	54	66	1.2	12.0	4.5	100
25 July	2	16	14	70	84	1.4	15.6	5.8	89
26 July	3	6	17	76	93	1.7	16.9	6.4	67
27 July	7	21	24	97	121	2.4	21.6	8.3	75
28 July	4	5	28	102	130	2.8	22.7	8.9	56
29 July	20	58	48	160	208	4.8	35.6	14.3	74
30 July	11	53	59	213	272	5.9	47.4	18.7	83
31 July	0	17	59	230	289	5.9	51.2	19.9	100
1 August	1	11	60	241	301	6.0	53.7	20.7	92
2 August	3	7	63	248	311	6.3	55.2	21.4	70
3 August	4	7	67	255	322	6.7	56.8	22.1	64
4 August	40	47	107	302	409	10.6	67.3	28.1	54
5 August	27	37	134	339	473	13.3	75.5	32.5	58
6 August	24	13	158	352	510	15.7	78.4	35.1	35
7 August	10	3	168	355	523	16.7	79.1	36.0	23
8 August	25	18	193	373	566	19.2	83.1	38.9	42
9 August	35	9	228	382	610	22.7	85.1	42.0	20
10 August	29	16	257	398	655	25.6	88.6	45.0	36
11 August	66	3	323	401	724	32.1	89.3	49.8	4
12 August	35	7	358	408	766	35.6	90.9	52.7	17
13 August	83	13	441	421	862	43.9	93.8	59.3	14
14 August	35	3	476	424	900	47.4	94.4	61.9	8
15 August	56	1	532	425	957	52.9	94.7	65.8	2
16 August	68	7	600	432	1032	59.7	96.2	71.0	9
17 August	60	2	660	434	1094	65.7	96.7	75.2	3
18 August	21	0	681	434	1115	67.8	96.7	76.7	0
19 August	22	0	703	434	1137	70.0	96.7	78.2	0
20 August	17	0	720	434	1154	71.6	96.7	79.4	0
21 August	73	0	793	434	1227	78.9	96.7	84.4	0
22 August	39	0	832	434	1266	82.8	96.7	87.1	0
23 August	20	2	852	436	1288	84.8	97.1	88.6	9
24 August	25	0	877	436	1313	87.3	97.1	90.3	0
25 August	31	0	908	436	1344	90.3	97.1	92.4	0
26 August	14	0	922	436	1358	91.7	97.1	93.4	0
27 August	19	0	941	436	1377	93.6	97.1	94.7	0
28 August	13	1	954	437	1391	94.9	97.3	95.7	7
29 August	10	1	964	438	1402	95.9	97.6	96.4	9
30 August	0	1	964	439	1403	95.9	97.8	96.5	100
31 August	4	0	968	439	1407	96.3	97.8	96.8	0
1 Sept	0	0	968	439	1407	96.3	97.8	96.8	
2 Sept	9	1	977	440	1417	97.2	98.0	97.5	10
3 Sept	6	3	983	443	1426	97.8	98.7	98.1	33
4 Sept	2	0	985	443	1428	98.0	98.7	98.2	0
5 Sept	0	1	985	444	1429	98.0	98.9	98.3	100
6 Sept	1	0	986	444	1430	98.1	98.9	98.3	0
7 Sept	2	0	988	444	1432	98.3	98.9	98.5	0
8 Sept	0	0	988	444	1432	98.3	98.9	98.5	
9 Sept	2	0	990	444	1434	98.5	98.9	98.6	0
10 Sept	4	0	994	444	1438	98.9	98.9	98.9	0
11 Sept	1	0	995	444	1439	99.0	98.9	99.0	0
12 Sept	0	0	995	444	1439	99.0	98.9	99.0	
13 Sept	0	0	995	444	1439	99.0	98.9	99.0	
14 Sept	0	0	995	444	1439	99.0	98.9	99.0	
15 Sept	0	0	995	444	1439	99.0	98.9	99.0	
16 Sept	0	0	995	444	1439	99.0	98.9	99.0	
17 Sept	1	0	996	444	1440	99.1	98.9	99.0	0
18 Sept	0	1	996	445	1441	99.1	99.1	99.1	100
19 Sept	1	0	997	445	1442	99.2	99.1	99.2	0
20 Sept	1	2	998	447	1445	99.3	99.6	99.4	67
21 Sept	0	0	998	447	1445	99.3	99.6	99.4	
22 Sept	0	0	998	447	1445	99.3	99.6	99.4	
23 Sept	4	1	1002	448	1450	99.7	99.8	99.7	20
24 Sept	0	0	1002	448	1450	99.7	99.8	99.7	
25 Sept	0	0	1002	448	1450	99.7	99.8	99.7	
26 Sept	2	0	1004	448	1452	99.9	99.8	99.9	0
27 Sept	0	0	1004	448	1452	99.9	99.8	99.9	
28 Sept	0	1	1004	449	1453	99.9	100.0	99.9	100
29 Sept	0	0	1004	449	1453	99.9	100.0	99.9	
30 Sept	1	0	1005	449	1454	100.0	100.0	100.0	0
1 Oct	0	0	1005	449	1454	100.0	100.0	100.0	
2 Oct	0	0	1005	449	1454	100.0	100.0	100.0	
3 Oct	0	0	1005	449	1454	100.0	100.0	100.0	
	1005	449							

Table 1c. Daily counts of resident and upstream migrating brook trout at English River, Labrador in 2000. Fence in operation from 7 July to 3 October, 2000.

	Number of trout				Cumulative numbers				Cumulative percent			
DATE	Resident	Sea run	Unknown	Total	Resident	Sea run	Unknown	Total	Resident	Sea run	Unknown	Total
7 July	0	0	0	0	0	0	0	0	0	0	0	0
8 July	0	0	0	0	0	0	0	0	0	0	0	0
9 July	0	0	0	0	0	0	0	0	0	0	0	0
10 July	0	0	0	0	0	0	0	0	0	0	0	0
11 July	0	1	0	1	0	1	0	1	0	0	0	0
12 July	0	0	0	0	0	1	0	1	0	0	0	0
13 July	0	0	1	1	0	1	1	2	0	0	2	0
14 July	0	0	1	1	0	1	2	3	0	0	4	0
15 July	0	0	3	3	0	1	5	6	0	0	10	1
16 July	0	0	0	0	0	1	5	6	0	0	10	1
17 July	0	0	3	3	0	1	8	9	0	0	16	1
18 July	0	0	3	3	0	1	11	12	0	0	22	2
19 July	0	0	2	2	0	1	13	14	0	0	27	2
20 July	0	0	4	4	0	1	17	18	0	0	35	3
21 July	0	0	1	1	0	1	18	19	0	0	37	3
22 July	0	0	4	4	0	1	22	23	0	0	45	4
23 July	0	1	0	1	0	2	22	24	0	1	45	4
24 July	1	0	3	4	1	2	25	28	0	1	51	5
25 July	1	4	0	5	2	6	25	33	1	2	51	5
26 July	7	7	0	14	9	13	25	47	3	4	51	8
27 July	4	11	0	15	13	24	25	62	5	8	51	10
28 July	5	3	1	9	18	27	26	71	7	9	53	12
29 July	0	2	0	2	18	29	26	73	7	10	53	12
30 July	2	0	2	4	20	29	28	77	8	10	57	13
31 July	0	0	3	3	20	29	31	80	8	10	63	13
1 August	0	1	0	1	20	30	31	81	8	10	63	13
2 August	0	1	0	1	20	31	31	82	8	10	63	13
3 August	4	0	0	4	24	31	31	86	9	10	63	14
4 August	4	0	1	5	28	31	32	91	11	10	65	15
5 August	1	0	1	2	29	31	33	93	11	10	67	15
6 August	1	4	5	10	30	35	38	103	11	12	78	17
7 August	3	2	0	5	33	37	38	108	13	12	78	18
8 August	0	0	2	2	33	37	40	110	13	12	82	18
9 August	8	3	0	11	41	40	40	121	16	13	82	20
10 August	3	9	0	12	44	49	40	133	17	16	82	22
11 August	5	3	0	8	49	52	40	141	19	17	82	23
12 August	4	7	0	11	53	59	40	152	20	20	82	25
13 August	2	1	3	6	55	60	43	158	21	20	88	26
14 August	2	4	0	6	57	64	43	164	22	21	88	27
15 August	8	4	0	12	65	68	43	176	25	23	88	29
16 August	7	1	0	8	72	69	43	184	27	23	88	30
17 August	8	9	3	20	80	78	46	204	30	26	94	33
18 August	8	7	0	15	88	85	46	219	33	28	94	36
19 August	3	9	0	12	91	94	46	231	34	31	94	38
20 August	2	2	0	4	93	96	46	235	35	32	94	38
21 August	0	9	0	9	93	105	46	244	35	35	94	40
22 August	3	3	0	6	96	108	46	250	36	36	94	41
23 August	2	1	2	5	98	109	48	255	37	36	98	42
24 August	0	1	0	1	98	110	48	256	37	37	98	42
25 August	0	4	0	4	98	114	48	260	37	38	98	42
26 August	2	4	0	6	100	118	48	266	38	39	98	43
27 August	0	2	0	2	100	120	48	268	38	40	98	44
28 August	1	6	0	7	101	126	48	275	38	42	98	45
29 August	0	0	0	0	101	126	48	275	38	42	98	45
30 August	0	4	0	4	101	130	48	279	38	43	98	46
31 August	0	1	0	1	101	131	48	280	38	44	98	46
1 Sept	0	0	0	0	101	131	48	280	38	44	98	46
2 Sept	4	5	0	9	105	136	48	289	40	45	98	47
3 Sept	4	8	0	12	109	144	48	301	41	48	98	49
4 Sept	1	27	0	28	110	171	48	329	42	57	98	54
5 Sept	2	4	0	6	112	175	48	335	42	58	98	55
6 Sept	0	0	0	0	112	175	48	335	42	58	98	55
7 Sept	0	4	0	4	112	179	48	339	42	60	98	55
8 Sept	0	0	0	0	112	179	48	339	42	60	98	55
9 Sept	0	0	0	0	112	179	48	339	42	60	98	55
10 Sept	1	2	0	3	113	181	48	342	43	60	98	56
11 Sept	1	1	0	2	114	182	48	344	43	61	98	56
12 Sept	0	0	0	0	114	182	48	344	43	61	98	56
13 Sept	9	5	0	14	123	187	48	358	47	62	98	58
14 Sept	0	0	0	0	123	187	48	358	47	62	98	58
15 Sept	3	1	0	4	126	188	48	362	48	63	98	59
16 Sept	4	14	0	18	130	202	48	380	49	67	98	62
17 Sept	8	11	0	19	138	213	48	399	52	71	98	65
18 Sept	11	14	0	25	149	227	48	424	56	76	98	69
19 Sept	1	3	0	4	150	230	48	428	57	77	98	70
20 Sept	87	33	0	120	237	263	48	548	90	88	98	89
21 Sept	24	21	0	45	261	284	48	593	99	95	98	97
22 Sept	1	6	1	8	262	290	49	601	99	97	100	98
23 Sept	0	2	0	2	262	292	49	603	99	97	100	98
24 Sept	0	0	0	0	262	292	49	603	99	97	100	98
25 Sept	1	1	0	2	263	293	49	605	100	98	100	99
26 Sept	0	0	0	0	263	293	49	605	100	98	100	99
27 Sept	0	0	0	0	263	293	49	605	100	98	100	99
28 Sept	0	1	0	1	263	294	49	606	100	98	100	99
29 Sept	0	1	0	1	263	295	49	607	100	98	100	99
30 Sept	0	0	0	0	263	295	49	607	100	98	100	99
1 Oct	0	5	0	5	263	300	49	612	100	100	100	100
2 Oct	1	0	0	1	264	300	49	613	100	100	100	100
3 Oct	0	0	0	0	264	300	49	613	100	100	100	100
Total	264	300	49	613								

Table 2. Summary of numbers of small (<63 cm) and large (>=63 cm) salmon, small (<40 cm) and large (>=40 cm) Arctic charr and Brook trout counted in Traps 1 and 2 in English River counting fence, 2000.

	Salmon							Arctic charr			Brook trout			
				Angled above fence		Spawning escapement								
Trap #	Small	Large	Total	Small	Large	Small	Large	Small	Large	Total	Resident	Sea Run	Unknown	Total
1	285	10	295					716	429	1145	182	145	33	360
2	82	5	87					289	20	309	82	155	16	253
Total	367	15	382	8	0	359	15	1005	449	1454	264	300	49	613

Table 3. Atlantic salmon biological characteristic data for English River, Labrador, 2000.

Class	Type	Fork length (cm)	Whole weight (kg)	Gutted weight(kg)	Female		River age distribution							
					Percent	Number		1	2	3	4	5	6	7	Total
Small salmon	Mean	53.2	1.66	1.52	17	1(6)	Number	0	0	3	49	17	0	0	69
	SD	2.46	0.33	0.33			Percent	0	0	4	71	25	0	0	100
	N	74	6	4											
Large salmon	Mean	73.3	NA	NA	NA	NA	Number	0	0	1	1	0	0	0	2
	SD	2.31	NA	NA			Percent	0	0	50	50	0	0	0	100
	N	3	NA	NA											
Grilse	Mean	53.3	1.66	1.52	17	1(6)	Number	0	0	3	49	17	0	0	69
	SD	2.46	0.33	0.33			Percent	0	0	4	71	25	0	0	100
	N	74	6	4											
2SW	Mean	73.3	NA	NA	NA	NA	Number	0	0	1	1	0	0	0	2
	SD	2.31	NA	NA	NA	NA	Percent	0	0	50	50	0	0	0	100
	N	3	NA	NA	NA	NA									
Repeat spawners	Mean	NA	NA	NA	NA	NA	Number	0	0	0	0	0	0	0	0
	SD	NA	NA	NA	NA	NA	Percent	0	0	0	0	0	0	0	0
	N	NA	NA	NA	NA	NA									
All salmon	Mean	54.0	1.66	1.52	17	1(6)	Number	0	0	4	50	17	0	0	71
	SD	4.61	0.33	0.33			Percent	0	0	6	70	24	0	0	100
	N	77	6	4											

Table 4 . Numbers and species of fish caught during fyke net survey of English River and Deer ponds in 2000.

Species	Number
Brook trout	155
Lake trout	1
Arctic charr	1
Salmon	
Parr	8
Smolt	9
Grilse	2
Sticklebacks	316

Table 5. Water chemistry measured in samples taken just upstream of trap #1 at English River, 2000.

Date	pH	Amonia Nitrogen (ppm)	NH3 (X1.2)	NH4+ (X1.3)	Dissolved Oxygen (ppm)	Alkalinity (ppm)	Hardness CaCo (ppm)	Carbon Dioxide (ppm)	Chloride (ppm)	Nitrite Nitrogen (ppm)	Water Temp. (C)
23-Jul	6.5	0.2	0.24	0.26	7.6	22					
30-Jul	6.5	0.2	0.24	0.26	8.1	18	38	4	8	<.05	
10-Aug	6.5	0.4	0.48	0.52	11.8	44	80	5	17	0.05	18
22-Aug	6	0.6	0.72	0.78	9	20	12	4	16	0	